148)

Venera 9

Nation: USSR (92)
Objective(s): Venus orbit and landing
Spacecraft: 4V-1 (no. 660)
Spacecraft Mass: 4,936 kg
Mission Design and Management: NPO Lavochkin
Launch Vehicle: 8K82K + Blok D (Proton-K no. 286-01)
Launch Date and Time: 8 June 1975 / 02:38:00 UT
Launch Site: NIIP-5 / launch site 81P
Scientific Instruments:

Orbiter:
1) imaging system
2) infrared radiometer
3) ultraviolet imaging spectrometer
4) magnetometer
5) photopolarimeter
6) ion/electron detectors
7) optical spectrometer

Lander:
1) panoramic imaging system
2) thermometer
3) barometer
4) mass spectrometer
5) anemometer
6) photometers
7) nephelometer
8) gamma-ray spectrometer
9) radiation densitometer
10) accelerometers

Results: Venera 9 was the first of a new generation of Soviet space probes ("4V") designed to explore Venus. Launched by the more powerful Proton launch booster, the new spacecraft were nearly five times heavier than their predecessors. Each spacecraft comprised both an orbiter and a lander. The 2,300-kilogram orbiters (at Venus orbit insertion) were designed to spend their missions photographing the planet in ultraviolet light and conducting other scientific investigations. The landers, of a completely new design, employed aerodynamic braking during Venusian atmospheric entry and contained a panoramic photometer to take images of the surface. Without any apparent problems and with two trajectory corrections (on 16 June and 15 October), Venera 9's lander separated from its parent on 20 October 1975, and two days later, it hit Venus's turbulent atmosphere at a speed of 10.7 kilometers per hour. After using a series of parachutes, the lander set down on the planet's day side at 05:13 UT on 22 October. Landing coordinates were 32° north latitude and 291° longitude at the base of a hill near Beta Regio. During its 53 minutes of transmissions from the surface, Venera 9 took and transmitted the very first picture of the Venusian surface from a height of 90 centimeters. These were, in fact, the very first photos received of the surface of another

planet. The lander was supposed to transmit a full 360° panorama, but because one of the two covers on the camera failed to release, only a 180° panorama was received. Illumination was akin to that of a cloudy day on Earth. The image clearly showed flat rocks strewn around the lander. The Venera 9 orbiter meanwhile entered a 1,500 x 111,700-kilometer orbit around the planet at 34°10' inclination and acted as a communications relay for the lander. It became the first spacecraft to go into orbit around Venus. The Soviets announced on 22 March 1976 that the orbiter's primary mission, which included using French-made ultraviolet cameras to obtain photographs in 1,200-kilometer swaths, had been fulfilled.

149)
Venera 10
Nation: USSR (93)
Objective(s): Venus orbit and landing
Spacecraft: 4V-1 (no. 661)
Spacecraft Mass: 5,033 kg
Mission Design and Management: NPO Lavochkin
Launch Vehicle: 8K82K + Blok D (Proton-K no. 285-02)
Launch Date and Time: 14 June 1975 / 03:00:31 UT
Launch Site: NIIP-5 / launch site 81P
Scientific Instruments:

Orbiter:
1) imaging system
2) infrared radiometer
3) ultraviolet imaging spectrometer
4) magnetometer
5) photopolarimeter
6) ion/electron detectors
7) optical spectrometer

Lander:
1) panoramic imaging system
2) thermometer
3) barometer
4) mass spectrometer
5) anemometer
6) photometers
7) nephelometer
8) gamma-ray spectrometer
9) radiation densitometer
10) accelerometers

Results: Venera 10, like its sister craft Venera 9, fully accomplished its mission to soft-land on Venus and return data from the surface. The spacecraft followed an identical mission to that of its twin, arriving only a few days later after two trajectory corrections on 21 June and 18 October 1975. The 660-kilogram lander separated from its parent on 23 October and entered the atmosphere two days later at 01:02 UT. During reentry, the lander survived gravity acceleration as high as 168 g and temperatures as high 12,000°C. It performed its complex landing procedures without fault and landed without incident at 02:17 UT approximately 2,200 kilometers from the Venera 9 landing site. Landing coordinates were 16° north latitude and 291° longitude. Venera 10 transmitted for a record 65 minutes from the surface, although it was designed to last only 30 minutes. A photo of the Venera 10 landing site showed a smoother surface than that of its twin. Like Venera 9, the Venera 10 lander was supposed to take a 360° panorama but covered only 180° of the surroundings because of a stuck lens cover. Meanwhile, the Venera 10 orbiter entered a 1,400 x 114,000-kilometer orbit around Venus inclined at 29°30'. Soviet officials later revealed that the termination of data reception from both Veneras 9 and 10 was not caused by the adverse surface conditions but by the flying out of view of the orbiter relays for both spacecraft. Gamma-ray spectrometer and radiation densitometer data indicated that the surface layer was akin to basalt rather than granite as hinted by the information from Venera 8.

150)
Viking 1
Nation: U.S. (56)
Objective(s): Mars landing and orbit
Spacecraft: Viking-B
Spacecraft Mass: 3,527 kg
Mission Design and Management: NASA LaRC (overall) and NASA JPL (Orbiter)
Launch Vehicle: Titan IIIE-Centaur (TC-4 / Titan no. E-4 / Centaur D-1T)
Launch Date and Time: 20 August 1975 / 21:22:00 UT
Launch Site: ETR / launch complex 41
Scientific Instruments:

Orbiter:
1) imaging system
2) atmospheric water detector
3) infrared thermal mapper

Lander:
1) imaging system
2) gas chromatograph mass spectrometer
3) seismometer
4) x-ray fluorescence
5) biological laboratory
6) weather instrument package (temperature, pressure, wind velocity)
7) remote sampler arm

Aeroshell:
1) retarding potential analyzer
2) upper-atmosphere mass spectrometer

Results: Viking 1 was the first of a pair of complex deep space probes that were designed to reach Mars and collect evidence on the possibility (or lack thereof) for life on Mars. Each spacecraft was composed of two primary elements, an Orbiter (2,339 kilograms) and a Lander (978 kilograms). The Orbiter design heavily borrowed from the Mariner buses, while the Lander looked superficially like a much larger version of the Surveyor lunar lander. Prior to launch, the batteries of the first spacecraft were discharged, prompting NASA to replace the original first spacecraft with the second, which was launched as Viking 1. After three midcourse corrections (on 27 August 1975 and 10 and 15 June 1976), the spacecraft entered orbit around Mars on 19 June 1976. Initial orbital parameters were 1,500 x 50,300 kilometers. The following day, when the Orbiter began transmitting back photos of the primary landing site in the Chryse region, scientists discovered that the area was rougher than expected. Using the new photos, scientists targeted the lander to a different site on the western slopes of Chryse Planitia. The Lander separated from the Orbiter, and after a complex atmospheric entry sequence, during which the probe took air samples, Viking 1 Lander set down safely at 22.483° north latitude and 47.94° west longitude at 11:53:06 UT on 20 July 1976. Once down, the spacecraft began taking high-quality photographs (in three colors) of its surroundings. Instruments recorded temperatures ranging from –86°C (before dawn) to –33°C (in the afternoon). The seismometer on the Lander was inoperable. On 28 July, the lander's robot arm scooped up the first soil samples and deposited them into a special biological laboratory that included a gas chromatograph mass spectrometer. While some data could be construed as indicating the presence of life, a major test for organic compounds gave negative Results. The Lander continued to return daily (and then eventually weekly) weather reports until loss of contact on 1 February 1983. Further attempts to regain contact proved unsuccessful. The Orbiter was shut down on 7 August 1980, after it ran out of attitude-control propellant.

151)
Viking 2
Nation: U.S. (57)
Objective(s): Mars landing and orbit
Spacecraft: Viking-A
Spacecraft Mass: 3,527 kg
Mission Design and Management: NASA LaRC (overall) and NASA JPL (Orbiter)
Launch Vehicle: Titan IIIE-Centaur (TC-3 / Titan no. E-3 / Centaur no. D-1T)
Launch Date and Time: 9 September 1975 / 18:39:00 UT
Launch Site: ETR / launch complex 41
Scientific Instruments:

Orbiter:
1) imaging system
2) atmospheric water detector
3) infrared thermal mapper

Lander:
1) imaging system
2) gas chromatograph mass spectrometer
3) seismometer
4) x-ray fluorescence
5) biological laboratory
6) weather instrument package (temperature, pressure, wind velocity)
7) remote sampler arm

Aeroshell:
1) retarding potential analyzer
2) upper-atmosphere mass spectrometer

Results: Viking-A was scheduled to be launched before Viking-B but had to be launched second due to a problem with its batteries that had to be repaired. After a successful launch and a midcourse correction on 19 September 1975, Viking 2 entered orbit around Mars on 7 August 1976, nearly a year after launch. As with Viking 1, photographs

The boulder-strewn field of red rocks reaches to the horizon nearly two miles from Viking 2 on Mars's Utopian Plain. Scientists believe that the colors of the Martian surface and sky in this photo represent their true colors. Fine particles of red dust have settled on spacecraft surfaces. The salmon color of the sky is caused by dust particles suspended in the atmosphere. Color calibration charts for the cameras are mounted at three locations on the spacecraft. Note the blue starfield and red stripes of the flag. The circular structure at top is the high-gain antenna, pointed toward Earth. Viking 2 landed on 3 September 1976, some 4,600 miles from its twin, Viking 1, which touched down on 20 July.

of the original landing site indicated rough terrain, prompting mission planners to select a different site at Utopia Planitia near the edge of the polar ice cap where water was located, that is, where there was a better chance of finding signs of life. The Lander separated from the Orbiter without incident on 3 September 1976 and, after atmospheric entry, landed safely at 22:37:50 UT about 6,460 kilometers from the Viking 1 landing site. Touchdown coordinates were 47.968° north latitude and 225.71° west longitude Photographs of the area showed a rockier, flatter site than that of Viking 1. The Lander was in fact tilted 8.5° to the west. The biology experiments with scooped-up soil produced similar results to that of its twin—inconclusive on the question of whether life exists or ever has existed on the surface of Mars. Scientists believed that Martian soil contained reactants created by ultraviolet bombardment of the soil that could produce characteristics of organisms living in Earth soil. The Orbiter continued its successful imaging mission, approaching as close as 28 kilometers to the Martian moon Deimos in May 1977. A series of leaks prompted the termination of Orbiter 2 operations on 24 July 1978, while Lander 2 continued to transmit data until 12 April 1980. In total, the two Orbiters returned 51,539 images of Mars at 300 meters resolution, that is, about 97 percent of the surface. The Landers returned 4,500 photos of the two landing sites.

152)
no name / [Luna]
Nation: USSR (94)

Objective(s): lunar sample return
Spacecraft: Ye-8-5M (no. 412)
Spacecraft Mass: c. 5,800 kg
Mission Design and Management: NPO Lavochkin
Launch Vehicle: 8K82K + Blok D (Proton-K no. 287-02)
Launch Date and Time: 16 October 1975 / 04:04:56 UT
Launch Site: NIIP-5 / launch site 81L

Scientific Instruments:

1) stereo imaging system
2) improved drill for sample collection
3) radiation detector
4) radio-altimeter

Results: This was the second attempt by the Soviet Union to send an "advanced" lunar sample return craft to the Moon, equipped with the capability to dig for a deeper core. The first spacecraft (Luna 23) was damaged during landing on the Moon in October 1974. On this mission, the first three stages of the Proton-K launch vehicle worked without fault, but the Blok D stage, during its first burn for insertion into Earth orbit, failed. The expensive payload burned up in Earth's atmosphere without ever reaching Earth orbit.